DISPLAY DEVICE

RELATED APPLICATIONS

[0001] This application claims priority to and the benefit of Korean Patent Application No. 10-2015-0144788 filed in the Korean Intellectual Property Office on Oct. 16, 2015, the entire contents of which are incorporated herein by reference.

BACKGROUND

[0002] 1. Field

[0003] The described technology relates generally to a display device.

[0004] 2. Discussion of the Related Technology

[0005] A display device is a device that displays an image, and recently organic light emitting diode displays have been attracting attention.

[0006] Organic light emitting diode displays have a self-emission characteristic and do not require a separate light source, unlike liquid crystal displays, and thus their thickness and weight may be reduced. Further, organic light emitting diode displays have high quality characteristics, such as low power consumption, high luminance, and high response speed.

[0007] In general, an organic light emitting diode display includes a substrate, a plurality of thin film transistors positioned on the substrate, a plurality of insulating layers disposed between wirings configuring the thin film transistors, and an organic light emitting element connected to the thin film transistor.

[0008] Recently, flexible organic light emitting diode displays, which include a flexible substrate made of a polymer material as the substrate, have been developed.

[0009] The above information disclosed in this Background section is only to enhance the understanding of the background of the described technology and therefore it may contain information that does not form the prior art that is already known in this country to a person of ordinary skill in the art.

SUMMARY

[0010] An embodiment provides a display device having improved durability.

[0011] One aspect of the invention provides a display device, which may comprise: a substrate comprising an outer area neighboring a border; an insulating layer positioned over the substrate and comprising a plurality of openings positioned over the outer area, the plurality of openings being disposed to be spaced from each other in a direction; and a wavy line extending in the direction and passing the plurality of openings.

[0012] In the foregoing device, the wavy line may be curved and extend along the top surfaces of the insulating layer and the bottom surfaces of the plurality of openings. The wavy line may contact the insulating layer. The display device may further comprise a cover layer covering the plurality of openings and the wavy line. The cover layer may have an island shape. The cover layer may comprise an organic material. The insulating layer may comprise an inorganic material. The insulating layer may comprise an organic material.

[0013] Still in the foregoing device, the device may further comprise a display unit neighboring the outer area and positioned over the substrate and comprising an array of pixels. Each pixel of the display unit may comprise an organic light emitting element positioned on the substrate; and a thin film transistor connected to the organic light emitting element. The organic light emitting element may comprise: a first electrode connected to the thin film transistor; an organic emission layer positioned over the first electrode; and a second electrode positioned over the organic emission layer. The thin film transistor may comprise: an active layer positioned over the substrate; a gate electrode positioned over the active layer; and a source electrode and a drain electrode connected to the active layer. The wavy line may be positioned on a layer the same as that of at least one of the gate electrode and the source electrode. The insulating layer may further comprise a first sub-insulating layer covering the gate electrode. The plurality of openings may be formed in the first sub-insulating layer. The insulating layer may further comprise a second sub-insulating layer covering the active layer. The plurality of openings may be formed on at least one layer of the first sub-insulating layer and the second sub-insulating layer. The insulating layer may further comprise a third sub-insulating layer positioned between the substrate and the active layer. The plurality of openings may be formed on at least one layer among the first sub-insulating layer, the second sub-insulating layer, and the third sub-insulating layer.

[0014] Another aspect of the present invention provides a display device including a substrate including an outer area neighboring a border; an insulating layer positioned on the substrate and including a plurality of opening patterns corresponding to the outer area and disposed to be separated from each other in one direction; and a wavy line extending in one direction and passing the plurality of opening patterns.

[0015] The wavy line may be curved and extend along the surface of the insulating layer and each lower part of the plurality of opening patterns.

[0016] The wavy line may contact the insulating layer.

[0017] A cover pattern covering the opening patterns and the wavy line may be further included.

[0018] The cover pattern may have an island shape.

[0019] The cover pattern may include an organic material.

[0020] The insulating layer may include an inorganic material.

[0021] A display unit neighboring the outer area and positioned on the substrate may be further included.

[0022] The display unit may include an organic light emitting element positioned on the substrate and a thin film transistor connected to the organic light emitting element.

[0023] The organic light emitting element may include a first electrode connected to the first thin film transistor, an organic emission layer positioned on the first electrode, and a second electrode positioned on the organic emission layer.

[0024] The thin film transistor may include an active layer positioned on the substrate, a gate electrode positioned on the active layer, and a source electrode and a drain electrode connected to the active layer.

[0025] The wavy line may be positioned on the same layer as at least one of the gate electrode and the source electrode.

[0026] The insulating layer may further include a first sub-insulating layer covering the gate electrode.

[0027] The opening pattern may be formed in the first sub-insulating layer.